

Joint 8th International Ticks and Tick-borne Pathogens (TTP-8) and 12th Biennial Society for Tropical Veterinary Medicine (STVM) Conference

24-29 August 2014



Cape Town South Africa

Poster Abstracts

Epidemiology, ecology and modelling for prevention and prediction

0254

Bayesian prediction of *Amblyomma variegatum* dynamics using hidden process models

David Pleydell^{1,2}, Bryan Sanford³, Patricia Powell⁴, Soledad Castaño^{1,2}, Jennifer Pradel², Rupert Pegram³

¹INRA, France, ²CIRAD, France, ³Caribbean Amblyomma Programme, Antigua and Barbuda, ⁴Veterinary services, Saint Kitts and Nevis

Objectives

In silico evaluation of tick and TBD control practices requires a predictive dynamic framework that (1) approximates key density dependant / independent processes affecting tick numbers (2) captures the effects of external stochasticity (3) integrates prior knowledge (4) quantifies uncertainties in model choice, parameter estimates and predictions. Ecological time series are arguably the single most important data type for fitting and testing ecological forecasting models, yet, for want of a coherent methodological framework, fitting stochastic non-linear dynamic models to ecological time series whilst meeting these four requirements has long been an elusive goal.

Method

Two recently proposed algorithms, PMCMC [1] and SMC2 [2], could change this. These algorithms use particle filtering to fit non-linear stochastic hidden process models to time series and can, in theory, provide Bayesian inference for biological process models. But how much biological detail can be integrated into models under this paradigm and whether these algorithms really represent the state of the art in ecological forecasting remain open questions. We explore these questions by fitting population dynamic models containing various levels of biological detail to *A. variegatum* time series obtained from the 13 year Caribbean Amblyomma Program.

Conclusions

Ecological interactions are inherently non-linear and even the simplest non-linear systems can exhibit complex dynamics [3]. Identifying key sources of non-linearity is a fundamental pre-requisite for ecological forecasting. We explore whether simple non-linear models can characterize *A. variegatum* population dynamics using modern Bayesian methods. The relative advantages and disadvantages of the new methods and their implications for control program evaluation are discussed.

References

[1] Andrieu, Doucet, & Holenstein (2010) J. R. Statist. Soc. B, 72; [2] Chopin, Jacob & Papaspiliopoulos (2013) J. R. Statist. Soc. B, 75; [3] May (1976) Nature, 261.